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Mitchell

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[54] **STRIP SHAPE CONTROL**

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[52] **U.S. Cl.** **72/17**; 72/250

[58] **Field of Search** 72/17, 21, 250, 183; 242/75.2

[56] **References Cited**

U.S. PATENT DOCUMENTS

3,078,747	2/1963	Pearson	80/56
3,499,306	3/1970	Pearson	72/17
3,820,367	6/1974	Kline	72/17
4,232,540	11/1980	Cain et al.	72/17
4,262,511	4/1981	Boisnert	72/17

OTHER PUBLICATIONS

U.S. application Ser. No. 940,651.

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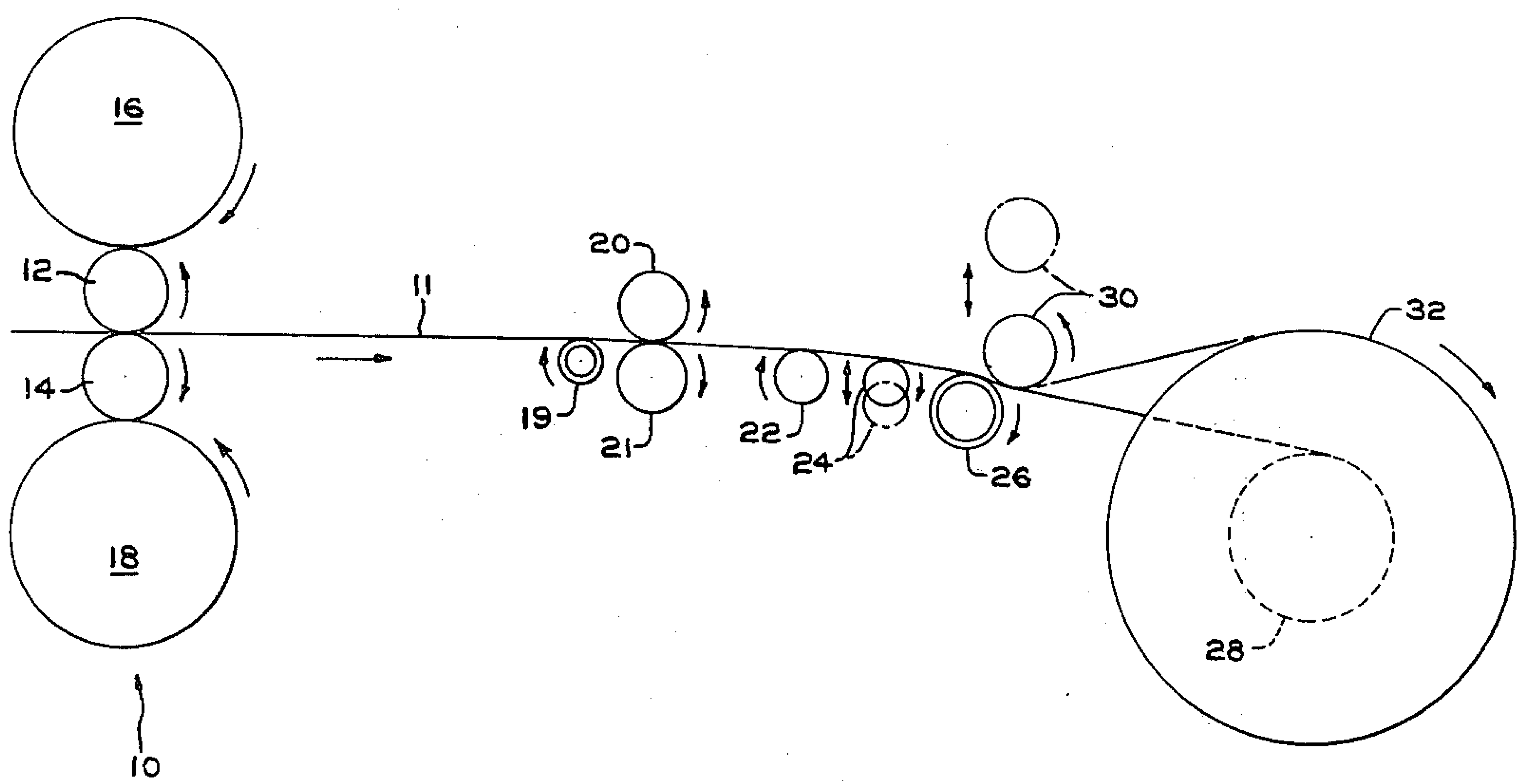
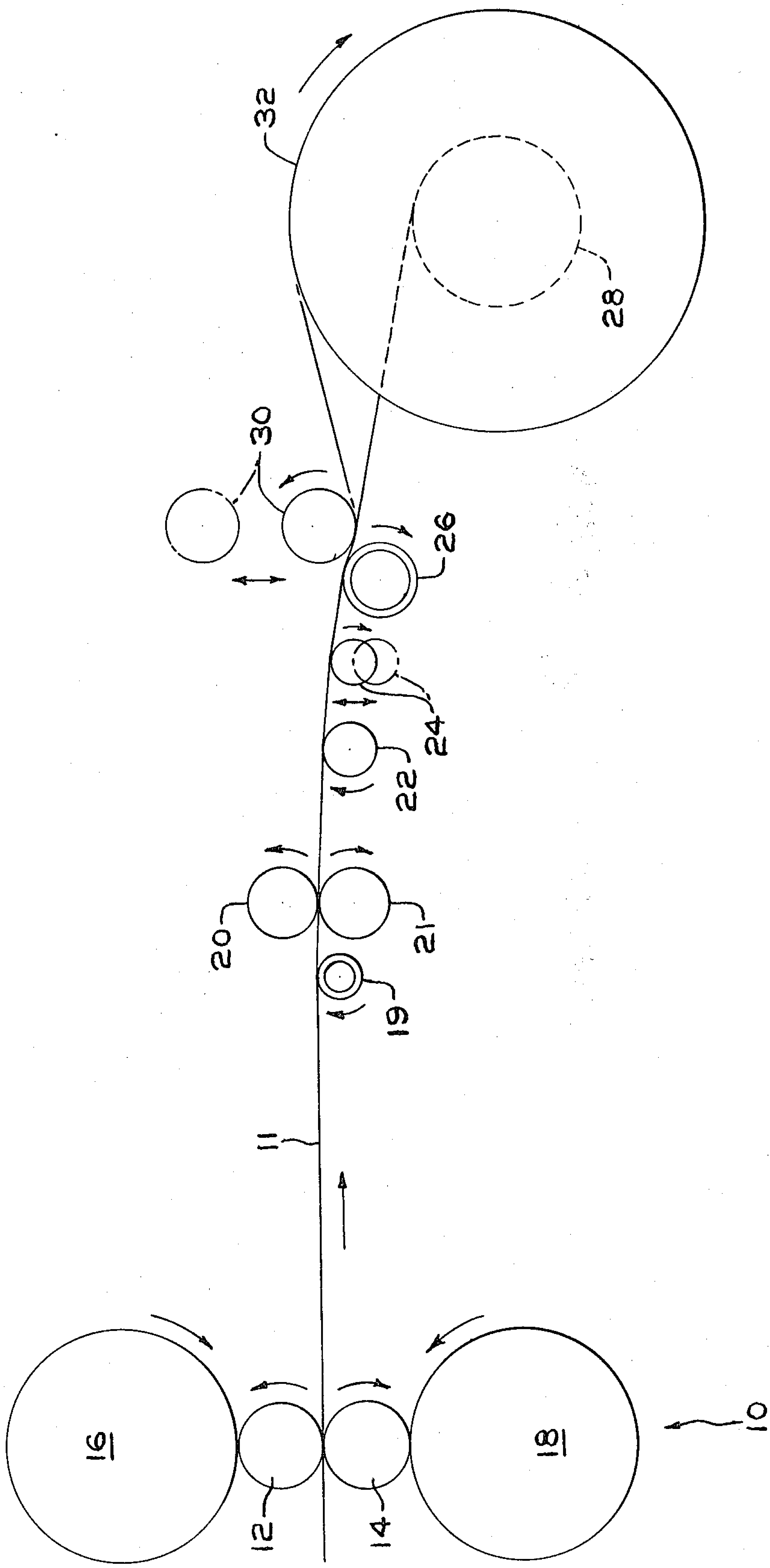
[57] **ABSTRACT**

In a metal strip rolling mill having a strip shape measuring means connected to adjust the mill to control the strip shape, improved strip shape control performance is achieved by mounting a hold-down roll between the measuring means and the take-up reel.

5 Claims, 1 Drawing Figure

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STRIP SHAPE CONTROL

BACKGROUND OF THE INVENTION

The concept of sensing the shape of metal strip emerging from a rolling mill and adjusting the mill in response to signals from the sensor, for improved strip shape control, is disclosed, for example, in Pearson U.S. Pat. Nos. 3,078,747 and 3,499,306. Such units have been proven effective in various commercial installations. However, there is some degree of undesired variation in strip shape even with the use of such controls, and efforts continue to be made to reduce the amount of this variation.

SUMMARY OF THE INVENTION

In accordance with the present invention, a hold-down roll is mounted between the strip gauge sensing unit which controls the mill and the take-up reel which coils the strip under tension. The hold-down roll is held against the strip with a controlled degree of pressure.

It is ordinarily the case that strip is rolled with a slightly greater gauge in the center than along the sides of this strip, and as the strip is coiled on the take-up reel in successive wraps the thicker portions of the strip in the middle tend to give a crown effect at the center of the coiled strip. This crown effect, in conjunction with the normal tension of the take-up reel, influences what the shape measuring unit senses, and thereby tends to distort the corrective signals from the sensing unit to the mill. In accordance with the invention, this distortion is minimized when the hold-down roll of the invention is pressed against the strip between the sensing unit and the take-up reel, under conditions where the sensing unit presses against one face of the strip and the hold-down roll presses against the opposite face of the strip.

Other details and advantages of the invention will be apparent as the following description of the presently preferred embodiment thereof shown in the accompanying drawing proceeds.

BRIEF DESCRIPTION OF THE DRAWING

The accompanying FIGURE schematically illustrates a side view of a rolling mill, take-up reel and strip shape sensing and control unit, with a hold-down roll in accordance with the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now more particularly to the FIGURE, the illustrated rolling mill **10** has a pair of work rolls **12** and **14** between back-up rolls **16** and **18**. A metal strip **11**, such as an aluminum strip, is reduced in gauge as it passes between the work rolls **12** and **14**. The strip **11** next passes over an idler supporting roll **19** and between a pair of edge trimming rolls **20** and **21**. Next, the strip **11** passes over an idler supporting roll **22**, a shape measuring roll **24** and a second idler supporting roll **26**, before being taken up on a tension take-up reel **28**. The shape measuring roll **24** senses the shape of the moving strip **11**, and is connected, by means not shown, to the rolling mill **10**, to make corrective changes in the operation of the rolling mill for purposes of attaining the desired shape of the strip **11** as it leaves the work rolls **12** and **14**. This strip shape measuring roll **24** is mounted to be vertically positioned away from the strip **11**, when required, to prevent damage to the shape measuring roll **24**. The rolling mill **10**, and rolls **19**, **20**, **21**, **22**, **24**, and **26**, the take-up reel **28**, and the automatic corrective action of the shape measuring roll **24** are old in the art relative to the present invention.

A cylindrical hold-down roll **30** in accordance with present invention is retractably mounted and in operation is pressed down against the upper surface of the strip **11** between the supporting roll **26** and the periphery of the coil **32** being wound on take-up reel **28**. The retracted position of roll **30** is shown in dashed lines. Hydraulic pressure means (not shown) are provided to maintain the roll **30** in proper position against positive adjustable stops (not shown) and against the strip **11**, in all positions of the strip as the coil **32** around the take-up reel **28** grows to its maximum diameter. In this way, the uneven tension across the width of the strip **11**, resulting from greater thickness of the strip in the middle than along its sides, is minimized, insofar as it may affect the sensing of the shape measuring roll **24**. As a result, better strip control results are obtained.

EXAMPLE

In accordance with the invention, aluminum strips were rolled in a strip rolling system as illustrated in the FIGURE and in which vertical height measurements were taken from the center of the nip between rolls **12** and **14** and horizontal spacing measurements were taken from vertical centerlines between the rolls. The supporting roll **19** was positioned 1925 millimeters from the rolling mill **12** and its uppermost height was 50 millimeters above the nip between rolls **12** and **14**. The trimming rolls **20** and **21** were positioned 325 millimeters from the supporting roll **19** and the nip between rolls **20** and **21** was positioned 52 millimeters above the nip between rolls **12** and **14**.

The supporting roll **22** was positioned 620 millimeters from the trimming rolls **20** and **21** and 50 millimeters above the nip between rolls **12** and **14**. This roll **22** had a diameter of 220 millimeters. The shape measuring roll **24** was positioned 370 millimeters from the supporting roll **22** and 21 millimeters above the nip between rolls **12** and **14**. The shape measuring roll **24** had a diameter of 180 millimeters. The supporting roll **26** was positioned 340 millimeters from the shape measuring roll **24** and 25 millimeters below the nip between rolls **12** and **14**. This supporting roll **26** had a diameter of 300 millimeters.

The hold-down roll **30** was positioned 250 millimeters from the supporting roll **26** and 50 millimeters below the nip between rolls **12** and **14**. The hold-down roll **30** had a diameter of 300 millimeters and applied a force of approximately 9071.8 kilograms to the strip **11**. The take-up reel **28** was positioned 1230 millimeters from the hold-down roll **30** and 710 millimeters below the nip between rolls **12** and **14**. The coil **32** had an inside diameter equal to the diameter of the take-up reel **28** of 650 millimeters and a maximum outside diameter of 1950 millimeters.

The strips **11** had thicknesses ranging between 0.2 and 4.5 millimeters nominal thickness as the strips **11** left the rolling mill **10** and a width of 1500 millimeters. The flatness across the width of the strips **11** was controlled to between 5 to 10 Alcan I units. This compares to flatness control of between 10 to 20 Alcan I units in the best comparable mills not employing the hold-down roll of the invention.

While a presently preferred embodiment of the invention and method of practicing the same has been illustrated and described, it will be understood that the invention may be otherwise embodied and practiced within the scope of the following claims.

What is claimed is:

1. In a metallic strip rolling apparatus comprising a rolling mill, a tension take-up reel to receive strip rolled through said mill and strip shape sensing means mounted between said mill and said take-up reel and constructed and arranged to adjust said mill for automatic correction of the shape of said strip being rolled in said mill, the improvement comprising a roll mounted to press against said strip between said shape sensing means and said take-up reel, said shape sensing means and said roll being in contact with opposite faces of said strip, and means responsive to the amount of said strip on said take-up reel for controlling the vertical position of said roll relative to said shape sensing means.

2. Apparatus according to claim **1** in which said shape sensing means is positioned beneath said strip and said roll is positioned above the strip.

3. Apparatus according to claim **1** in which said shape sensing means rolls against said strip.

4. In a method of controlling the shape of a metallic strip as its thickness is reduced in a rolling mill wherein the shape of said strip is sensed at a sensing position by contact with said strip as said strip passes to a take-up reel, the improvement comprising contacting a roll against said strip between said sensing position and said take-up reel, said sensing contact and said roll contact being on opposite faces of said strip, and responding to the amount of said strip on said take-up reel by controlling the vertical position of said roll relative to said sensing position.

5. The method of claim **4** wherein said strip is aluminum.

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